The Scottish Mathematical Council

MATHEMATICAL CHALLENGE

2014–2015

Solutions

Primary Division: Problems I

P1.1

Chris has found a three-digit number. The number which uses some of the figures 0, l, ..., 9 can be read back to front and upside down but it stays the same.

Find all the possibilities for Chris's number.

Solution

101, 111, 181, 808, 818, 888

Guidelines

P1.2

How many whole numbers between 1 and 1000 do not contain the digit 1?

Solution

A reasonable strategy is count the numbers which contain 1.

Between 1 and 99, numbers 1, 10 to 19, and 21, 31, … 91 contain 1 (at least once), i.e. 19 numbers.

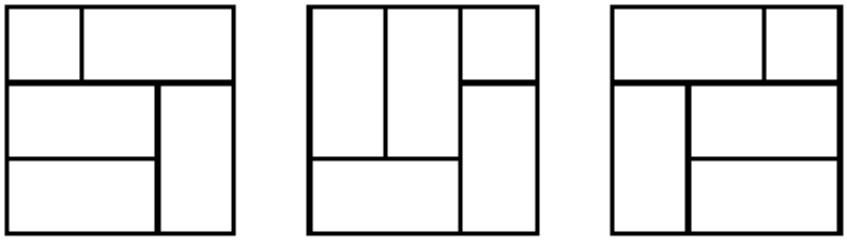
Numbers from 100-199 all contain the digit 1 i.e. 100 in total.

Between 200 and 299 a further 19 numbers contain the digit 1, and similarly for each further hundred, i.e. 8×19 in all.

Finally, 1000 contains the digit 1.

Overall $9\times19 + 100 + 1 = 272$ contain the digit 1, and so $1000 - 272 = 728$ do not contain the digit 1.

P1.3

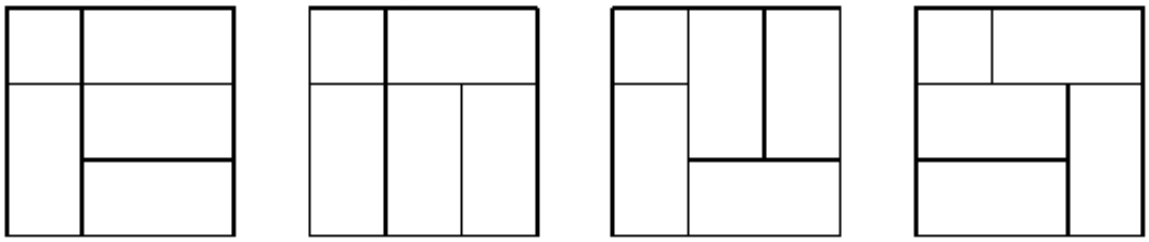


Three different ways of dividing a 3×3 square into one 1×1 square and four 2×1 rectangles are shown above. How many ways are there in all (including the ones shown above)?

Solution

The second diagram is a rotation of the first, and the third is a mirror image of the first. So we must count mirror images and rotations separately.

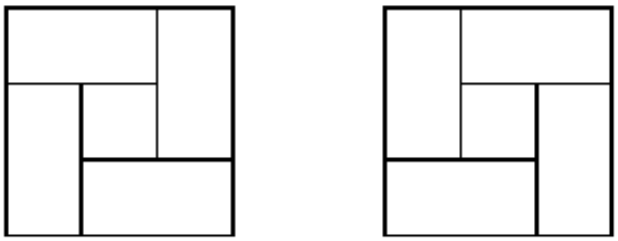
There are 4 ways with the 1×1 square in the top left corner:



and hence $4 \times 4 = 16$ ways with a 1×1 square in any corner.

It is not possible to cover the 3×3 square when the 1×1 square is in the centre of an edge.

There are 2 ways with the 1×1 square in the centre, which are mirror images:



This gives a total of 18 ways.